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TRADITIONAL PALM OIL PROCESSING WOMEN'S ROLE AND THE APPLICATION OF APPROPRIATE TECHNOLOGY

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African Training and Research Centre for Women

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SUMMARY AND CONCLUSIONS

Summary

This study documents the role of women in the traditional palm-oil processing industry in Sierra Leone, the Ivory Coast and the United Republic of Cameroon and examines attendant problems and difficulties women producers face in this field. In addition the study reviews experiences obtained in applying appropriate technologies to traditional palm-oil processing methods. In particular, it offers a critical assessment of one attempt to introduce such technologies specifically to women through the Sierra Leone Government's palm oil press project, sponsored by the ECA's African Training and Research Centre for Women. The study also assesses the place of improved traditional and small-scale palm-oil processing industries with women participating, within the general framework of palm-oil production in the three countries. Finally, the study proposes new guidelines and orientations for introducing improved palm-oil processing technologies to women at the community and small-scale levels and offers recommendations on means for diffusion of technical information on the development of new palm-oil presses.

Conclusions

The study concludes that, while it is premature to state accurately what role women might have in small-scale mechanized oil processing mills and plants, there is at the present time a clear place for women in an improved traditional processing industry.

There exists a considerable range of technologies to improve traditional processing methods. However - and this is substantiated in the assessment of the Sierra Leone project which lacked realistic pre-implementation technical and socio-economic information - a number of points must be examined prior to selecting the technology most apt to satisfy particular needs in a given environment. They include social, economic and technological factors, a knowledge of the technologies currently in use and an assessment of the competitiveness of traditional processing methods in given conditions. A careful study of these factors could determine which of the various stages in traditional palm-oil processing require technological innovations so that improvements may offer maximum benefits (labour savings, increased income and/or higher productivity) to intended beneficiaries - in the case of this study, women.

The study reaches three other important conclusions. First, users must be sufficiently motivated if a new technology is to be successfully promoted and accepted. In other words, users must accord the technology a high priority. Secondly, the approaches for dissemination of a new technology and the choice of effective channels for its dissemination deserve careful consideration. Finally, there is a need for built-in monitoring systems to serve as a signal for modifications and adjustments in projects during their implementation.

Part One

INTRODUCTION

I. BACKGROUND

This study is a result of the recognition by the African Training and Research Centre for Women (ATRCW) of the Economic Commission for Africa of:

(a) The important place of women among Africa's food producers (70 percent of whom are women);

(b) The role of women in processing Africa's most widely-used edible oil;

(c) The conviction that no serious approach to the development of Africa's food industry potential can afford to ignore the crucial role of women in producing and processing food.

In view of this, existing experiences with improved traditional palm-oil processing would understandibly contribute significantly to a workshop which was concerned with the problem of small-scale palm-oil processing in Africa. 1/ Hence this study was undertaken to assess the role of women in the traditional palm-oil industry and examine the introduction of new technologies in three countries, the Ivory Coast, Sierra Leone and the United Republic of Cameroon.

The specific terms of reference of the study were:

(1) To identify the role of women in the traditional palm-oil processing industry and analyse the situation, problems and difficulties of women producers in this field;

(2) To undertake a critical assessment of a specific oil press project in Sierra Leone in order to examine its successes and failures and reasons therefore;

(3) To highlight changing patterns of work and work habits when a new technology is introduced and to discuss the necessity to predict and programme such changes if success is to be achieved;

(4) To assess critically the place of improved traditional palm-oil processing and small-scale industries within the general framework of palm-oil production in Africa as well as the place of women in such industries;

(5) To make proposals for new guidelines and orientations for the introduction of improved technologies in the field of palm-oil processing by women at the community and small-scale industry level.

All but (3) above have been addressed in this study; the reason for this omission will be evident in the section covering the results of the assessment of the oil press project in Sierra Leone.

II. ORGANIZATION OF THE STUDY

Five sections follow the introduction.

(a) In the first section a description of the traditional palm-oil processing industry in each of the three countries of the study attempts to identify, with quantitative data when available, the role of women in production activities.

(b) The second section discusses experiences to date in the use of appropriate oil-processing technologies, with particular emphasis on the Sierra Leone oil press project.

(c) The third section examines improved traditional and small-scale processing industries from the perspective of the overall oil-producing industry of the three countries, with special emphasis on participatory aspects for women.

(d) The fourth section concludes the study with proposals for the introduction of improved palm-oil processing technologies and offers recommendations on methods for disseminating information on new technologies.

NOTES

Part One

1/ Reference is made here to the First African Small-Scale Palm Oil Processing Workshop, held in Benin City, Nigeria at the offices of the Nigerian Institute for Oil Palm Research (NIFOR) from 12 to 16 October 1981.

Part Two

TRADITIONAL PALM-OIL PROCESSING AND WOMEN'S ROLE

I. GENERAL

The traditional method of processing palm oil is lengthy. While details may vary from country to country, the process is generally as follows. Once stripped from the bunches, the fruit is boiled, often in a large 44-gallon petrol drum. It is then pounded in a wooden mortar with a pestle, a process which crushes the pulp and leaves a mixture of pulp and kernels. Next, the kernels are separated from the pulp, and a variety of approaches exist at this stage. The oil is subsequently extracted, usually manually, often being skimmed from the surface of water. Lastly the crude oil is boiled so as to obtain a refined final product.

It has been estimated that the extraction rate (defined as the ratio of extracted oil to total oil in the fruit) for traditionally processed oils ranges between 40 and 45 per cent, though it can be as high as 50 per cent. 1/

II. TRADITIONAL PROCESSING AND WOMEN'S ROLE IN WEST AFRICA

A. Ivory Coast

It should be noted at the outset that in the Ivory Coast, the traditional method of processing palm-oil has changed considerably since the 1960s. In the Adioukrou region, for instance, palm oil was traditionally processed in the fields. This was a collective activity in which the entire family participated. However, although women did help, the work was primarily viewed as a male activity. 2/

Today, the processing of palm oil has moved into the villages, and it now appears to be the responsibility of individuals. In the Dabou and Ababo Baoule areas, located respectively 40 and 18 kilometres from Abidjan in the heart of wild palm groves, previously women were primarily in charge of separating pulp from kernels, leaving the task of extracting the oil to men. Today the responsibility of women extends to the extraction of the oil as well. These two examples are the direct result of developments in the palm-oil industry in the Ivory Coast. 3/

Two different traditional processes currently in use in the Ivory Coast are described below. The first is typical of the Adioukrou region near Dabou. The stripped fruit is first boiled, then covered with banana leaves and allowed to ferment for about three weeks. Freshly-boiled fruit is added to the fermented batch, and the mixture is pounded, either in a mortar or in one half of a 44-gallon drum. Following this, the pulp is separated from the kernels, then boiled to extract the oil.

This particular process is usually done entirely by women. However, depending on the quantity of fruit involved, they may require the help of men to pound the mixture. For reasons detailed in Part Four of this study, the amount of fruit so processed is usually quite small.

A second approach to traditional processing is characteristic of the Ebrie region in the Abobo Gare area. Once the bunches of fruit - called régimes in the Ivory Coast - have been gathered, the fruit is stripped and boiled, then allowed to ferment for four to five days. In the case of a five-day fermentation period, the fruit is pounded on the sixth day and the processing begins on the seventh. The pulp is separated from the kernels. In the past, the pounded fruit was then put in a container and covered with boiling water to extract the oil. Today, the pulp is brought to a boil, then simmered for some time before cold water is added to it to allow for manual extraction of the oil. The crude oil so obtained is then boiled to produce a pure oil.

In this particular process, because the quantities of fruit involved are often small, the pulp and kernels are sometimes squeezed together, thus allowing for a more direct extraction of oil. And as in the previous example, the processing is primarily the work of women.

B. Sierra Leone

Palm-oil production and processing in Sierra Leone are largely artisanal, using traditional processing methods. Women play an important role here, processing the fresh fruit bunches (called "ffb"), from wild palms to produce palm oil, then the fibre, bunch refuse and sludge to make local soap. It has been estimated that 90 per cent of the wholesale and retail palm-oil trade is in the hands of women.

A number of methods have been used in Sierra Leone in the traditional processing of palm oil. Two of these are described here.

The first method, explained in a Consortium for International Development publication, 4/ allows for a partial fermentation of the fruit. The fruit is then boiled, and the kernels are separated from the mesocarp, or fibre, which contains the oil. They are placed in a receptacle full of water so as to allow the remaining oil to float off. Meanwhile, the mesocarp is left in a container for the night. The following morning, boiled water is added to this container so that the oil will melt faster. The chaff (or pulp) is then removed, leaving a mixture of water and oil. The final step is to skim off the oil and heat it to the boiling point, removing any traces of water and producing a pure oil.

In the second, and most popular method, the fruit is allowed to soften for about two days, following which it is boiled, usually in a 44-gallon drum, and placed in a dug-out pit in the ground. The softened fruit is then crushed by foot. (When smaller quantities of fruit are processed, the mixture is pounded in a mortar.) Once the mixture has been mashed, it is washed in water poured into the pit. The oil thus floats up, whereafter it is scooped from the surface and boiled in large drums to obtain a pure oil. Estimates indicate that depending on the availability of labour, three to six 44-gallon drums of ripe palm fruit can be processed daily using this method.

Both men and women are involved in the processing of palm oil in Sierra Leone. While men harvest the fruit, they share with women the tasks of stripping fruit off bunches and crushing the pulp and kernels with their feet. The women, however, are responsible for hauling water with which to wash the crushed fruit and for boiling the crude oil to produce a pure oil. A detailed breakdown of the labour input required in the traditional processing of palm oil in Sierra Leone is not currently available.

C. United Republic of Cameroon

Traditional palm-oil production accounts for over 70 per cent of total palm-oil production in the United Republic of Cameroon. It is heavily concentrated in the Northwest, in the Mom area and the Makak, Mafou, Nyong and Kelle districts of the Central South, and in Burea in the South West. The Littoral and Central South provinces are amongst the principal wild grove production areas of the eastern part of the country.

There are an estimated 2,000 hectares of wild oil palm groves of the Dura species in the North Western province of Cameroon. The region, however, has no large industrial plantations or affiliated small-holder or outgrower programmes. Processing is therefore in the hands of independent producers and individual farmers who operate at the village level.

A recent study details the current processing method and describes the critical role of women in the production of oil in the Ngie region of the Northwest. 5/

> The fruit bunches are normally left in a heap covered with palm leaves or banana leaves. The raw fruits are subsequently easily removed from the bunches by women and children and taken by the women in rectangular baskets on the back, to the oil production site. These sites are frequently near a small stream in the palm grove, because ample water is needed. The loose fruits are cooked with water in metal containers, which are preferably half or whole 200-litre petrol drums. The children look for firewood. After 6 to 8 hours cooking, the fruit is placed in a depression (isim) in the ground, surrounded by stones, and trampled by women

with their feet while they support themselves with one or two sticks. Water is added to the fruit pulp by a women or a girl to wash the oil out of the pulp. The oil is collected in a small depression at the end of the isim. Subsequently, the oil is taken to the house and cooked for one or two hours to evaporate the water in the oil. The presence of water in the oil reduces the shelf life of the oil. The oil is put in all kinds of containers.

As is the case in Sierra Leone, where oil is sometimes processed in a pit, this method clearly allows producers to handle sizeable quantities of fruit. Three to five persons could be in the isim at any one time crushing fruit.

In contrast to Sierra Leone, actual production of oil in the Northwest is predominantly the work of women. One estimate suggests that women contribute as much as 83 per cent of the total labour required in the production of one tin of palm oil. This represents extraction, transportation and marketing. Male labour, which covers harvesting, accounts for the remaining 17 per cent. 6/

In the southern parts of the United Republic of Cameroon, estimates for labour requirements in the traditional processing of one drum of fruit vary widely. 7/ At Buea in the South West, the figure totals 34 hours, of which eight are spent on marketing. At Otele, in the Makak district of the Central South region, 52 hours are needed to process one drum of palm nuts. In both cases, the labour input is predominantly female, with male labour harvesting and collecting fruit bunches.

Estimates from the Otele area deserve a special mention, because of the improvements in traditional processing methods in the region. 8/. The estimate of 52 hours is based on the measured time value (actual hours of work) of the activities required in several villages to process one drum of fruit. A drum of mixed palm nuts of the wild Dura and improved Tenera varieties holds 20 bunches or 115 kg of nuts, and yields 20 kg or 22 litres of oil. The study of measured time value shows a requirement of 18 man, or 33.5 women-hours to produce the amount of oil. Men work at three specific activities: they harvest and strip fruit bunches, transport the fruit to cooking sites in the village, and clear ground. Female labour concentrates on all aspects of the actual processing; however, 55 per cent of their time is spent crushing the fruit, hauling water and skimming off oil.

III. PROBLEMS AND DIFFICULTIES

Based on the previous analysis, traditional palm-oil processing in the Ivory Coast, Sierra Leone and the United Republic of Cameroon can be qualified as long, tedious and laborious. The detailed estimates available for Cameroon support this claim. They also show the need for

similar quantified information from other geographic areas. Specific measurements of labour requirements for the traditional production of palm oil, including a break-down of the female labour input by activity would help to define the magnitude of the problem. Such information is essential in identifying necessary improvements in specific activities of the oil production process. It would also offer a better understanding of the economics of traditional palm-oil production.

During the course of the study, several country-specific constraints were cited. The most relevant of these are listed below.

In the Ivory Coast, processors in villages with no access to a hand press rank the tedious task of separating nuts from pulp, once the boiled fruit has been pounded, as the major problem. The rather small income derived from palm oil processing is another constraint. However, this is a function of the quantity of fruit available for traditional processing, which in turn reflects the approach adopted by the Ivory Coast in developing its oil-palm industry. 9/

In Sierra Leone, women must haul considerable amounts of water to process the sizeable quantities of fruit available to traditional palm-oil producers. Thus, because the peak period of production coincides with the dry season, traditional processors cite lack of water supply as their greatest constraint. More generally, production of palm oil is also found to be physically exerting. Finally, although the extent to which women share in the proceeds of sales is unclear, there is reason to believe that income generated from palm-oil processing represents an important source of revenue for village women. This, however, requires systematic documentation.

In the United Republic of Cameroon, despite their heavy involvement in palm-oil processing, women, in the North West in particular, hardly benefit from their labours, if at all: the proceeds from the sale of oil traditionally accrue to men. Transportation is a serious constraint to women both in the processing of the oil and in its marketing. This item is particularly relevant as processing occurs near streams, and the road network in Cameroon is limited. Water supply is also described as a problem for processors.

NOTES

Part Two

1/ C.W.S. Bartley, The Oil Palm, Tropical Agricultural Series, 2nd.ed., (Longman, 1977), p. 7

2/ M. Dupire and J.L. Boutillier, Le Pays Adioukrou et sa Palmeraie, Basse Côte d'Ivoire, OSTROM, Paris 1958.

3/ For further discussion on this subject see Part Four of the study.

4/ USAID, Agricultural Sector Assessment Report for Sierra Leone, Consortium for International Development, Logan, Utah, July 1980, pp. 128-129.

5/ G. Blaak, Feasibility study for a village palm oil mill Moro Division, Northwest Province, United Republic of Cameroon. Consultant report to HIVOS, Rural Tropical Institute, Amsterdam, the Netherlands, May 1981.

6/ The estimates are attributed to Mahoni of the USAID mission to Cameroon and were cited by Gunter Traut at the NIFOR workshop in Benin City, in his presentation "Manpower and Economic Analysis of Traditional Palm Oil Processing in Cameroons". Traut is a technical advisor to the Ministry of Economic Affairs and Planning in Yaounde.

7/ Ibid.

8/ For a further discussion on this topic, see Part Three.

9/ For a further discussion on this subject, see Part Four.

Part Three

DESCRIPTION OF APPROPRIATE TECHNOLOGIES AND EXPERIENCE IN THEIR APPLICATION

I. INTRODUCTION

The following section consists of three parts:

(a) A listing of technologies used in the processing of palm oil in the Ivory Coast, Sierra Leone and the United Republic of Cameroon, and a brief analysis of the successes and problems experienced in their application;

(b) A comprehensive analysis of one specific application of such a technology - the Sierra Leone oil press project;

(c) An examination of the economic implications of appropriate technologies in the palm-oil processing field.

The expression "appropriate technologies" refers to technologies that are need-oriented and appropriate to existing conditions and that both increase the productivity levels and reduce the work load of traditional techniques. Simple agricultural equipment that aids in processing food - in this case, oil presses - falls into this category.

II. EXPERIENCES WITH IMPROVED TECHNIQUES IN TRADITIONAL PROCESSING

A number of examples were found of improved technologies in use in the palm-oil processing industry in the three countries under study.

A. Ivory Coast

Two different types of presses were seen in operation at the village of Kpass, located near Dabou some 18 km from Abidjan in the Ivory Coast : there were a total of six Tikonko-like presses 1/ and one curb press of the type popular in eastern Nigeria.

To a certain extent the presses are being used for commercial purposes in the village. Apparently when oil is being processed for sale, women generally use the mechnical presses; oil produced for domestic consumption, on the other hand, is often processed traditionally. Thus both processes, the improved using the presses and the traditional, are evident in one same village.

In these areas, a major portion of the fruit used in extracting oil comes from improved varieties; it is usually loose fruit, found around the small-holder village plantations that form satellites around the larger, government-controlled industrial oil palm estates. Since it is improved, the fruit can be pressed with or without its kernel

It is worth nothing that the presses at Kpass date back to the 1950s, when the first oil factory was established at Dabou, and presses were introduced at Mopyem. Villagers have expressed concern about obtaining new presses to replace, eventually, the ones on hand, as these are fast aging. While women in the Dabou area have been exposed to the presses and appreciate the advantages they offer, women in neighbouring Abobo Gare appear uninformed of the existence of technologies which could alleviate their work load.

B. Sierra Leone

Two types of press predominate in Sierra Leone. The first, a small "Abu" press, has been in operation for the past four years. The second, the "Tikonko" press, is found in the Bo area and named after the Tikonko Agricultural Extension Centre. Both are screw presses, designed primarily to process improved varieties of fruit. The boiled and pounded fruit can be loaded without removal of kernels.

The Abu press can service an 8 to 10-acre farm growing improved oil palm. Its major advantages are, reputedly, its efficiency and the fact that it doesn't require water in processing the oil. It is being used in Pujehun, in the Southern province of the country.

Discussions were held with the owner of a 1975 Tikonko press, who demonstrated the operation of the equipment. The size of the farm it serviced was approximately 12 acres, and the owner found its processing capacity adequate to his needs. The press cylinder can hold one-fifth of a 44-gallon drum of pounded fruit; each load yields 1.5 gallons. During the peak production season -four to five months of the year - the farmer gathers about three 44-gallon drums of fruit every harvest, or every 21 days.

C. United Republic of Cameroon

Two very different and interesting types of presses were found in use around Yaounde and in the Central South province of Cameroon. The first was designed by the Cameroon National Centre for Studies and Experimentation in Agricultural Mechanization (CENEEMA). The second, the "Otele" press, is named after the southern Cameroon region where it is in operation.

The CENEEMA press system comprises both a press and a depulper: the latter, which operates manually on friction, eliminates the need to crush the boiled fruit with the feet or to pound it in a mortar. It can depulp 10 kg of fruit at a time and takes one minute to load and one minute to depulp. The capacity of the depulper corresponds to that of the press, which can handle 40 kg of fruit at a time 2/ and up to two tons of fruit a day. With regard to its extraction rate, 10 kg of palm fruit processed in the press yield approximately one litre of oil. The labour required to operate it is one to two persons.

A description of the CENEEMA press system is contained in Annex I. The depulper, a relatively new component of the system, has been in existence for a little over a year. According to CENEEMA, two or three depulpers have been sold for use in Cameroon, but there has not yet been much feedback on their performance. Apparently the component has not been actively advertised, though there are plans for its promotion. The press, on the other hand, has been on the market for some time.

The major drawback of the CENEEMA press, whose mechanism is a simple jack, is that the fibre must be manually separated from the nuts once the fruit has been depulped.. Because of this the press hasn't gained wide acceptance; villagers in the south expressed a lack of interest during demonstrations. The press' major competitor, however, was not the traditional method, but rather a unique press in use in the area at the very time CENEEMA attempted a wide-scale application of its own invention.

The Otele press is used in the Bassa area of the Central South. In a unique system it combines the processes of depulping the fruit and extracting the oil. The only requirement is to boil the fruit and load it into the machine. The oil is then extracted at one end of the press while mashed chaff and nuts are expelled at the other end. The technique is described as a continuous system. Another interesting feature of this press is that it can be operated either manually or mechanically, with a small 5-horse power motor. A note on the Otele press is contained in Annex I.

The Otele press, which dates back to the late 1940s, was originally manufactured by Pressoirs Colin SRA in Montreuil, France. Although the presses are no longer in production, quite a few remain in use in Cameroon; five were examined during the course of the study. Both men and women operate the presses, whether manually or mechanically. In one case, using the motorized version of the press, four women and two men were processing oil.

A planter who owns the equipment indicated that, using the power-driven Otele press, one drum of fruit could be processed in 23 minutes. Other users stated that it took a maximum of 45 minutes to process one drum of fruit using the manual version. (There are indications, however, that one hour is probably a more realistic figure.) As regards output from the manually-operated press, the owner estimated that one drum of wild grove Dura fruit yields 30 litres of oil; with a same amount of improved Tenera, this figure increases approximately to 45 or 50 litres. Again, these yield figures could conceivably be inflated, since the machines are quite old. Furthermore the results of a study on measured physical yield with such presses show somewhat lower figures.. 3/

III. THE SIERRA LEONE OIL PRESS PROJECT

A. Background

The Sierra Leone oil press project represents joint efforts on the part of the country's Ministry of Social Welfare and Rural Development and the Economic Commission for Africa to introduce appropriate technologies to traditional processors of palm oil at the village or community levels. In summary, the Ministry of Social Welfare and Rural Development, with financial support from the Economic Commission for Africa, asked the engineering department of Fourah Bay College to design a small palm-oil press which would be portable and simple to operate. Following the design made by the college, 4/ a request was made for the manufacture of thirteen palm-oil presses. These were to be tested in various villages in the palm-oil producing regions of the country.

In January 1979, villagers were informed of the pending installation of oil presses and they responded positively to the idea. 5/ The press, it was explained, had been designed and built to alleviate the more tedious aspects of palm-oil production and with the longer-term objective of improving the economic, social and cultural conditions of producers. 6/ By April 1979, a total of five presses were available for field testing, which began while the remaining 8 machines were being manufactured.

B. Description of the press

The following is a very brief description of the press : a more detailed note is contained in Annex I. The palm-oil press, which rests on a three legged-stand, consists of two perforated cylinders. The inner cylinder, made of galvanized iron sheet and appropriately termed the pressing cylinder, measures roughly 9" in diameter and 13" in height. The outer cylinder, roughly 15½" high, is made of iron plate. When in operation, the inner chamber is loaded with boiled and pounded fruit ,and then placed in the outer cylinder.

The oil is extracted by rotation. This is accomplished by means of a handle attached to a screw thread, to which a piston is connected. The oil flows through holes from the inner to the outer cylinder.

To further facilitate the flow of oil, the press also has a small boiler, approximately 13" high and 11" in diameter, with a 2-gallon capacity. Using firewood for fuel, it generates steam that heats the inner cylinder through a rubber hose enclosed in a galvanized jacket.

C. Field test experience

Although all the oil presses were eventually installed as planned, there was apparently little field testing in the thirteen villages. In summary, some villagers refused to try the press

following the initial demonstration; others, in the village of Rokoya, refused on sight to use the machine; at Kissi Koya, the press was damaged while in operation and had to be taken to Freetown for repairs. At the time of the mission - one year after the original installation - this press had still not been returned to the village.

Other difficulties which affected the field tests were:

(a) Inappropriate timing: the presses were introduced during the off-season for palm-oil production.

(b) Inadequate supervision: there was an apparent lack of demonstration and supervision when the presses were first introduced.

The presses were summarily tested, and results were obtained in three (23 per cent) of the thirteen project villages. Villagers cited four major reasons for their failure to use the machines. 7/

(1) The machines were found to be too small.

(2) From the standpoint of manpower, there was no difference between the time consumed processing oil in the traditional manner and with the presses.

(3) The traditional method yielded more oil than did the presses.

(4) The machine was not easily operated by women.

Villagers did not detail any of their practical experiences in the actual operation of the press, which suggests that the machines were not in use long enough to draw valid technical conclusions. A listing of technical deficiencies, however, was provided by an independent oil-palm planter who, though not part of the project, had used the press. His comments are detailed below.

Finally, and again because of unsustained utilization of the presses as substantiated by social workers in charge of monitoring, the project did not produce any substantive information on changing patterns of work or work habits as a result of the introduction of the press.

D. Experience of independent planter with the press

The experience of a single oil-palm planter is clearly insufficient basis for final conclusions. However, in the absence of any other data from users, it does offer some insights into technical issues that might have influenced acceptance of the technology. It should also be noted that, as a rather well-to-do farmer, the planter was using the improved varieties of fruit which do not require separation of nuts from pulp prior to processing.

The following were the planter's observations on the press:

(1) The boiler, with its 2-gallon capacity, frequently required additions of fresh water, a time-consuming operation as the water needed to be brought to a boil each time before the extraction process could continue. Furthermore, this increased the consumption of fuelwood, which is a scarce commodity in Sierra Loone. Indeed, the consumption of firewood appears to be a major constraint to wide use of the press. In this case, the planter adapted half of a 44-gallon drum for use as a boiler, which supplied enough water for a day's work.

(2) A considerable amount of waste matter accumulated after the first two pressings and blocked the flow of extraction. A third pressing produced a mixture of oil and waste. The solution to this problem was to clean the cylinder repeatedly another factor that slowed down the processing. Interestingly, this is a direct result of utilization of fattier, improved varieties of fruit and would probably not have occured with the wild-grove palm fruit.

(3) The cylinder was too small for the planter's purpose and, he estimated, could have been enlarged to three times its actual size. As it was, the press could only process one 44-gallon drum of fruit per day, as compared with a daily load, when labour is available, of six drums using the traditional method.

(4) The press yielded only six gallons of oil per 44-gallon drum of fruit. In comparison, the yield, using the traditional method, is eight gallons of oil for the same amount of fruit.

(5) Given the large quantities of fruit available for processing in Sierra Leone, the need to pound the fruit prior to loading it in the press was a constraint. This was further aggravated by labour shortages, and the planter felt this aspect of the press should be improved.

E. Summary assessment of results

Essentially the difficulties experienced in the Sierra Leone oil press project revolve around issues such as prerequisites and methodology for introducing a new technology.

In this particular case, a number of basic questions were not answered prior to implementation. Did the villagers themselves determine they needed a press and, more importantly, did they partici-

pate in the design and selection of an appropriate press? Discussions with the project Director and Field Co-ordinator indicate that this aspect was missing. The next question is one of motivation. In the villagers' minds, were the difficulties experienced with the existing traditional processing method crucial enough to warrant a new technology? Did the villagers attribute a high priority to this need? Again, facts show that these issues were not covered prior to project implementation; the villagers were not convinced of the economic benefits of the new presses, when compared with the traditional processing method. The experience of the project suggests that needs did not guide the design but, rather, that the design was imposed regardless of village requirements.

The major cause for rejection was that the press did not fulfill the needs of the villagers. Given the history of the project, this is understandable. Economic and technical omissions in the preparatory work account for some of the problems experienced in the project. First, although a survey did yield some data on quantities of fruit processed traditionally, no such information was incorporated into the design characteristics of the press: the only specifications the Ministry imposed on the University at the design stage were simplicity and transportability. These design features did not address the question of volume of production.

Another critical deficiency was the need to separate manually nuts from pounded fruit - a time-consuming and tedious chore. Because this is traditionally a communal activity which involves women and children, absence of mechanization for this activity, it was believed, might increase the chances for acceptance of the press. The reverse occured.

Finally, designers of the press did not give sufficient consideration to the type of fruit used in the processing: in Sierra Leone, villagers have access to wild-grove palm; well-to-do farmers are the primary users of the improved varieties. Again, the former type of fruit must be pounded and separated prior to loading in the press - another fact which rendered the press unattractive. 8/

The problems experienced in implementing the oil press project in Sierra Leone show that attemps to introduce new technologies for women require a well-planned feasibility study and provisions for critical factors in the design of the technology. Some specific lessons from the project are listed hereafter.

(1) Women must be consulted on the design of equipment if its mechanical features are to satisfy processing requirements and be perceived as appropriate improvements. In particular, equipment designers should work with women in examining the different steps in traditional processing and identifying possible improvements so that the suggestions of experienced processors are incorporated in the characteristics of the press.

(2) Supervision, training and monitoring are critical elements if users are fully to appreciate the usefulness of the technology. In the case of monitoring, practical inputs such as transportation must be written into the project so that user experiences can be recorded properly and systematically.

(3) Serious thought must be given to the selection of an appropriate channel for dissemination of a new technology. Critical criteria required in identifying the most effective channel include the experience of organizations in and their exposure to methodologies and approaches for the introduction of technologies to specific environments. The objective, of course, is to achieve optimal results in presenting a new concept.

(4) Projects such as the Sierra Leone oil press project attempt to raise agricultural productivity of small farmers through implementation of activities that are not traditionally limited to women. As such, these projects deserve to be incorporated into the mainstream of agricultural development projects with the proviso, in their design, that women participate in the introduction of the technology: these projects, if given a broader definition, would not only train women in the use of innovative equipment but would also address issues such as ownership and control of the machinery - questions which experience has shown to be crucial in determining the extent of women's access to appropriate technologies.

IV. INSIGHTS INTO THE ECONOMICS OF IMPROVED TRADITIONAL PROCESSING

This section has described a variety of technologies available for improved traditional processing of palm oil: information is now required on the economics of the industry. To undertake a substantive economic analysis of the issue, hard empirically-generated data is required - information based on observations and recordings which were not included in the terms of reference of the study It is, however, possible to identify some of the economic factors involved such as capacity, yields and existence or extent of commercial uses of improved technologies. It should be noted, however, that the facts here are for the most part based on user experience, with no opportunity for further verification. Figures should be viewed as indicative of possible results of applications of improved processing technologies at the village level. The following is therefore a rather simplified economic discussion. The expression "improved traditional processing" here means the improvement of a specific activity or task in the traditional processing of palm oil. As such, one step or activity - often the most critical - may benefit from application of a new technology while subsequent stages remain most effective when performed in the traditional manner.

The Tikonko screw press experience indicates that small hand presses are ideally suited for the small holder with 5 to 10 acres, and for areas where the supply of fruit is irregular. Using the press, the oil-to-ffb extraction rate is about 18 per cent, an increase over the 6 to 10 per cent obtained traditionally. And the usual efficiency rate (ratio of extracted oil to total oil in ffb) of the press is generally about 80-95 per cent, as compared with a 40-55 per cent rate using the traditional process.

The improved technologies discussed here tend to be used commercially. This was the case both in the Ivory Coast and Cameroon. In essence, owners of the equipment allow others to process their fruit in exchange for a monetary or in-kind payment. This clearly implies that the individual village producer only has access to small quantities of fruit. Indeed, it has been estimated that 75 to 80 per cent of total palm oil produced in Africa (excluding the Ivory Coast) originates from the category of agriculturalists defined as small-holders.

In the village of Kpass in the Ivory Coast, the use of a screw press, 11" in diameter and 19½" high and yielding 20 litres of oil per cylinder load of fruit, costs 50 CFA francs per pressing. 9/ Three to five people use the press daily, with an average of five to seven pressings per person. In the same village, charges for the use of a curb press, 22" in diameter and 20" high, is 150 CFA francs per cylinder load. The yield from this press cage is higher, usually about 30 litres. Some ten persons use this press daily, for an average of one to three cylinder loads per person. It should be repeated here that villagers tend to use these presses when processing oil for commercial use and revert to the traditional process when the oil is destined for personal consumption.

In Cameroon, payment for use of the Colin Otele press is in kind: the cost is 25 per cent of the crude oil extracted. Using the lowest price for a litre of oil in the area -- about 150 CFA francs the cost for processing 20 litres of oil is 5 litres, or about 750 CFA francs.

Some figures on the manpower inputs for these presses are also available. The labour requirements for traditional processing are considerable. In a previous section reference was made to a time-measure study of manpower requirements for specific processing activities in Otele, in the Maka district of central-south Cameroon. The study found that critical steps in traditional processing required a total of 18.5 "women-hours", broken down as follows:

1.5 hours	for two women, squeezing hot nuts
4.5 hours	for 3 women to haul water
12.5 hours	for 2 women to pound fruit, add water and skim off oil.

This could be replaced by three hours of work using the Colin Otele press. 10/ It is also worth noting that the 18.5 woman-hours listed above represent but 55 per cent of the total female labour input of 33.5 hours required in the traditional processing of one 115 kg drum of nuts or 200 kg of fresh fruit bunch. The measured yield for the same drum of fruit, using the Colin press, was 29 kg or 32 litres of oil with the mixed fruit varieties, as compared with a yield of 20 kg or 22 litres of oil using the traditional method. Using the Colin press, wild-grove fruit yielded 20 litres, and improved Tenera 42 litres of oil.

A significant inference from the time-measure study is that women's labour can be replaced altogether through utilization of the improved traditional processing. The justification is that since women do not often profit from their labour in the palm-oil industry, 15 women-hours of physically-demanding work could be saved. This has been documented in the case of Northwest Cameroon. 11/ Another interpretation of the study is that in Northwest Cameroon, while improved traditional processing may relieve women of an arduous task, it will not insure them increased productivity, nor will it secure for them a greater portion of the proceeds accrued through use of improved technologies.

In the Mom area of Southcentral Cameroon, 12/ where presses are also available, the case is different: a study shows that women control the exploitation of palm trees and derive considerable income from the sale of processed oil. 13/ Obviously, the position of women differs greatly in northern and southern Cameroon. This underlines the need for more information on the subject of proceeds from palm-oil extraction in order to ascertain how they are divided between men and women, if at all, who controls them, and to what extent, if at all, women, whose labour inputs have been well documented, share in that income.

Another economic consideration in the application of improved technologies is their impact on the manufacture of by-products. As specific activities in processing still require the use of traditional methods, improved technology will not necessarily have an adverse effect on the production of by-product. For example, the sediment obtained when refining crude palm oil, ketekemou, or kpotoi in Sierra Leone, has economic value in that it is used either as animal food or in the production of local "black" soap. This underlines the importance, when appraising the economics of improved traditional processing, of assessing the feasibility of continuing the production of the same or similar by-products produced previously.

A final, but critical, economic consideration is the consumption of fuelwood with some types of presses. The need for firewood, a scarce and expensive commodity, could easily entail financial expenses that would discourage the use of the new technology. In this

particular case, alternative energy sources, such as dried chaff, could be investigated. The significant point, however, is that costs to the user must be factored in when analysing the economics of improved traditional processing.

V. CONCLUSIONS

In view of the considerable range of technologies for improved traditional processing of palm oil, the selection of the most appropriate technology for a given environment requires a careful examination of social, economic and technical factors, a thorough review of the technical state-of-the-art as well as an analysis of the competitiveness of traditional processing under given conditions. This last item may further necessitate a study to determine which of the various activities that make up traditional processing might benefit from technological innovation. Finally, any such effort should thoroughly document the role of women in processing activities, if there is to be a sound assessment of the impact of technological change on women's work patterns. 14/

If this approach is applied when introducing appropriate palm-oil processing technologies, the Ivory Coast would probably respond in a positive manner to a press such as the one used in the Sierra Leone oil press project. A better selection, though, would be a combination of this press and the CENEEMA depulper: research has indicated that in villages in the Ivory Coast, small-scale producers have access to small quantities of improved varieties of oil palm - two characteristics that would adapt well to the combination mentioned above. And the CENEEMA depulper could probably be successfully introduced to villages currently using screw presses as well.

In Sierra Leone, the approach described above might conclude that the Colin press in use at Otele is the technology most apt to satisfy the country's traditional processing requirements. A second-best solution would be, again, to combine the CENEEMA depulper with a press that would separate nuts from pulp after fruit maceration -- for instance, a hand depericaper. The second component in this option would have to be designed. Or, attempts might be made to incorporate the critical design features of the Colin Otele system, which is no longer being produced, into a new press that would sell at a sufficiently low price to encourage its use at village and community levels.

In this connexion, CENEEMA in Yaounde is considering such a possibility. Additionally, another manufacturer has expressed interest in opening a plant to produce the Colin Otele press system, should he find sufficient demand for the equipment. The minimum required to start production would be twenty machines, at a cost of 1.6 million CFA francs. An order of some 100 presses would reduce the total cost to about 1.2 million CFA francs.

Finally, in light of the dicussion on the economics of improved traditional processing, it cannot be sufficiently emphasized that improved palm-oil processing technologies will only gain acceptance if they successfully compete with all critical aspects of the traditional processing methods - the product itself and its required quality, productivity, labour inputs and time requirements.

NOTES

Part Three

1/ For a description of the Tikonko press, see Section B on Sierra Leone in the following pages.

2/ This represents the fibre and pericaps, or skin, from 40 kg of nuts.

3/ Section IV which follows gives a detailed account of these figures.

4/ Apparently, the press had initially been developed by the Ministry of Agriculture; its design was subsequently adopted by the University.

5/ Sierra Leone, Ministry of Social Welfare and Rural Development. Report on ECA/Sierra Leone Government oil press project, period June 1978-January 1979.

6/ Ibid, report for period March 1980-April 1981, Freetown, August 1981.

7/ Ibid.

8/ The experience of the private planter shows, however, that the press is not ideally suited for the Tenera palms either.

9/ The price fluctuates between 150 and 300 CFA francs. At the time of publication, US$1.00 was equal to 3.83 CFA francs.

10/ Traut, "Manpower and economic analysis of traditional palm oil processing in Cameroon," op.cit.

11/ G. Blaak, Feasibility study for a village palm oil mill, op.cit.

12/ Jacques Champound, Mom, Terroir Bassa, OSTROM, Paris, 1973.

13/ For a further discussion on this topic, see Part Four of the study.

14/ A similar point was made by Marilyn Carr in "Appropriate technology for African Women", (ECA/SDD/ATRCW/VTGEN/78) United Nations, 1978.

Part Four

OUTLOOK FOR IMPROVED TRADITIONAL AND SMALL SCALE PALM-OIL PROCESSING INDUSTRIES AND ASSESSMENT OF WOMEN'S ROLE THEREIN

An assesssment such as the one attempted in this section has to keep two factors in perspective in order to be effective. First, it must give consideration to the pattern and present stage of development of the palm-oil industry in countries of interest; secondly, it must take into account the time element -- the short term as well as the medium to long term. These factors are therefore brought into focus as they apply to the Ivory Coast, Sierra Leone and the United Republic of Cameroon.

I. IVORY COAST

The palm-oil industry in the Ivory Coast has been described as the most developed in Africa. 1/ The pattern of development, devised in the early 1960s, combines state-owned nucleus plantations with satellite-village, small-holder or out-grower plantations. Schematically, the system is organized in large industrial estates and plantation blocks equipped with mills which service the estates on the one hand, and village small-holder lands within a radius of twenty kilometres from the factories on the other. The small-scale planters harvest their fruit and are responsible for collection of the bunches. These are deposited at given sites on the plantations for collection by Palmindustries, the state co-operative which owns the facilities at the estates and is in charge of processing the fruit. Thus, within this system, the village planter is not expected to take an active part in processing his own harvest.

There are at present approximately 51,000 hectares of industrial and 38,000 hectares of small-holder oil-palm plantations in the Ivory Coast.2/ In view of this pattern of development in the industry, the traditional, or wild grove, production and processing have, for all practical purposes, disappeared, in fact, the Ivory Coast's five year development plan anticipated no increase in production from that source between the years 1975 and 1980 and predicted an actual decline, by 1985, from 250,000 to 220,000 tons. 3/

The palm-oil industry is now about to enter a new phase in its development. Factors including ecological considerations and shortages of manpower, amongst others, appear to be reducing the expansion of large industrial blocks: due to a lack of tracts of land, there will only be two new estates established in the near future. In consequence, attention may shift to small-scale oil-palm blocks and hence, to small-scale processing facilities to service them. 4/

While opportunities for small-scale processing are not encouraging in the short term, the medium-to-long term offers brighter prospects. The issue of female participation in this development will very much depend on how processing facilities are organized, whether they are integrated within a co-operative system, or whether the state develops

them. Should production and processing be organized along co-operative lines, current labour shortages in the Ivory Coast coupled with the country's intent to limit its dependence on immigrant labour might open the door for women to participate. However, it remains premature to say more at the present time.

Prospects for improved traditional processing are bright both in the short and medium term. This should be qualified, however, with the comment that limited supplies of fruit will restrict the expansion of this type of processing at the village level: essentially villagers can only process the loose fruit of improved varieties that they find around the plantations. 5/ Since this fruit technically belongs to and should be processed by Palmindustries, traditional processors - even those using improved technologies - can't expect to have access to large quantities of fruit.

On the other hand, village planters located beyond Palmindustries' 20-kilometre collection radius who now use the traditional processing method could potentially become users of improved technologies. In this case, in as much as women are already involved in village-level traditional processing of fruit from these areas, there might be a place for them in such industries in the Ivory Coast. However, while the exact figure of village planters in this categoty remains undetermined at present, their numbers probably are not significant.

II. SIERRA LEONE

In Sierra Leone agriculture is essentially organized along traditional lines, with but a few plantation-type activities. Here the small-scale farmer plays a significant role in agricultural development. For its part, the oil-palm industry relies on wild-grove palms for its supply of fruit and on traditional processing methods for the extraction of oil. Only recently, in the mid-1970s, has the country witnessed the establishment of large plantations of improved oil palm. There are now a few estates with satellite outgrowers -- the Mattru Gambia and Dabu Oil Palm Companies and the Sierra Leone Produce Marketing estate. They usually have their own milling facilities, but the bulk of fruit grown in the country is still processed traditionally. In fact, traditional processing apparently succeeds in competing economically with the modern mills.

These facts are particularly significant in assessing the short- and medium-term prospects for improved traditional and small-scale processing in Sierra Leone. Following the lead set by industrial estates, a fair number of farmers have planted their own lands with improved varieties of fruit. 6/ They are generally well-to-do individuals and clearly represent a good market for a future improved traditional palm-oil processing industry. In addition, a considerable proportion of the industrial estates' outgrowers also prefer to process their fruit in the traditional manner, for reasons of economy described below. In the short term, therefore, Sierra Leone could have viable improved traditional and small-scale processing industries.

In the medium to long term, any substantial development in the small-scale processing industry would depend on two major factors: fluctuations in market prices for fruit as established by the industrial mills, which remain major purchasers, and the future of the Integrated Agricultural Development Projects (IADP) out-grower scheme.

The first factor is evident: when mills purchasing fruit pay a high enough price they automatically become the main recipients of commodities; conversely, when they lower their prices, more oil will be processed in the traditional manner. In addition, the Sierra Leone Produce Marketing Board (SLPMB) can affect distribution of fruit between industrial and traditional processors through its pricing of kernels. Consequently any future small-scale mill processing facilities will have to incorporate these fluctuations into estimates of supply of fruit.

The second factor influencing the planning and creation of any such industries is the possible expansion of small holder estates, with the eventual result that farmers, unable to cope with increases in production, will resort to small-scale businesses for the processing. Small-holders attached to the Daru and Mattru-Gambia state companies in IAPD areas now harvest 5 to 10 acres of improved oil palm, of which 30 per cent is traditionally processed by the individual planters. The remainder of the output is sold to project or private mills. 7/ Improved technologies that increase the extraction rate of traditional processing might attract more business from these particular planters.

The outlook for Sierra Leone's women as participants in improved traditional processing is positive, from two perspectives.

First, women form approximately 10 per cent of the IADP out-growers and are excellent potential buyers of improved technologies. To the extent that such equipment could be made available to them, their participation in the industry would increase.

Secondly, women already represent the major portion of the labour force in the palm-oil processing industry and describe their work as physically demanding. They would certainly willingly accept new technologies that not only reduce the more exerting aspects of the work, but also prove to be economically viable and appropriate to their needs. Again, this would require proper introduction including training and guarantees for women of access to equipment.

Some indications of prospects for the participation of women in small-scale processing industries are available through the experience gained in the Eastern Clinic Rural Development Project. 8/ Women who work at the oil-palm processing facilities near Mobai in the Eastern Province's Kailahun district are involved in two activities, both of them associated with the purification of crude

oil. First, women clarify the oil once it has been extracted and collect the waste matter, or sludge, passing it on to users who transform it into soap. Women also make packaging cartons for the soap. Women are not, however, involved in making the soap itself. It should also be noted that the number of women participating in this project is quite limited.

III. UNITED REPUBLIC OF CAMEROON

The palm oil industry in the United Republic of Cameroon has developed primarily along a pattern of large estates. The concept of small holders operating under the supervision of larger estates was only introduced recently -- in 1978 in the case of the Cameroon Development Corporation. At SOCAPALM, another example, village plantations only cover some 500 ha; this compares with 6 million ha of industrial groves. 9/ In eastern Cameroon, too, there are few small-holder farms. 10/

Despite the government control of industrially-organized oil-palm plantations, the country, and particularly its Northwest, Central South and Littoral provinces, has considerable wild groves. An improved traditional processing industry exists: examples discussed earlier -- Otele in the Central South, Mom near Makak -- are cases in point. Looking at the short term it could be argued that the current situation speaks for itself. And field investigations suggest that there is a place for women within this type of industry. This position is further substantiated by previous research which documented the involvement of women as follows:

> The female headed household of which there were a large number in the Mom area (about 20 per cent of the total), derived the principal portion of their cash income (55 per cent) from the sale of palm oil. This was achieved either through the help of young men in the family or by finding someone to collect the nuts from the trees the women controlled. The oil derived from the nuts would be shared with the collector on a fifty/fifty basis. 11/

This description contrasts, however, with the situation in Northwest Cameroon, where women do not earn the proceeds of their labour. A particularly significant finding for this region is the need, already identified earlier in the study, for expanding the improved traditional oil-processing industry by addition of presses. And in the Central South region, the high fee charged to users of commercial presses (20 to 25 per cent of the extracted oil) has been cited as a reason for increasing the amount of equipment in that region as well. 12/

A recent MULPOC report for Central Africa 13/ recommends that emphasis must not shift away from integrating small-scale, modern processing facilities into the mainstream of agricultural development actions in the sub-region. In the particular case of Cameroon, small-scale processing is apparently gaining momentum - a clear indication of its viability in the short and medium term.

Two developments, one in western Cameroon and the other in the North West, have influenced this. The first revolves around a group of independent oil-palm planters, not operating under the direct supervision of the Cameroon Development Corporation (CDC) at Victoria, yet acting as CDC fruit suppliers. Prior to starting its own outgrower programme, the CDC had provided these small-holders with improved seedlings. These same planters have recently expressed an interest in establishing their own processing plant: the feasibility of such a venture would clearly have to be weighed against the advantages of the current system of sale to CDC.

The second development comes as a result of increased planting, by individuals and on areas of 100 hectares or more, of the improved Tenera palms in the Northwest region over the past several years. The planters' ability to process the increased quantities of produce in the traditional manner is reaching its limit.

The co-operative movement in the Northwest has joined in the move to expand the land under improved palm cultivation, by establishing nurseries of Tenera seedlings for sale to farmers. As a result the coming years will witness increases in production of improved palm fruit, a situation that will in turn require the creation of additional small-scale processing facilities. 14/

The Cameroon Fifth National Development Plan (1981-1986) anticipates the establishment of eleven village palm-oil mills. Creation of these facilities, to be managed by co-operative societies, should raise the processing capacity in the area to levels required by the expected increase in production of fresh fruit bunches. A study was recently completed on the feasibility of setting up a village palm-oil mill near Teze, in the Momo Division of the Northwest province, in the early half of 1982: plans are now underway to implement the scheme with outside financial support.

One essential implication of the feasibility study is that women will no longer be active participants in the actual production of palm oil in a newly established, small-scale processing industry. In spite of the negative interpretation this might be accorded, respondants were supportive of such a development, citing their relief at no longer needing to engage in tedious activities for which they did not earn any income: they view the change as an opportunity to work in other more profitable areas such as food crop farming. Three advantages are immediately apparent: first, the women will increase their real earnings; secondly, women's co-operatives will still be involved in the small-scale processing industry to the extent that they will receive the waste matter from the mills for use in soap production; finally, women will continue to sell fruit to the mills. 15/

The above discussion does examine the extent of female participation in small-scale oil-palm processing in the near future in Cameroon and concludes that the role of women may be rather limited.

But it also offers alternative forms of involvement through secondary processing enterprises that would generate both employment and income. Activities like the manufacture of soap could be integrated as components of projects that introduce new technologies, and in fact their inclusion should be high-ranking criteria in evaluating improved technologies. The experience gained through the Sierra Leone oil press project can offer designers guidance in identifying the possible by-products of improved processing that are of interest to beneficiaries.

IV. CONCLUSION

As has been shown, improved traditional and small-scale palm-oil processing industries do have a legitimate place within the general framework of palm-oil production and processing in the three countries of the study. Small, five- to ten-acre oil-palm village plantations - the average individual holding in Sierra Leone - are very much in need of improved and income-earning processing facilities for use by individual producers. Larger plantation owners could form co-operative groups when establishing small-scale processing industries; if the size of land under oil-palm cultivation warrants, they could even create their own mills: an example of this is the Manduwulo palm-oil mill at Mobai in Sierra Leone. A component in the Eastern Clinic Rural Development Project, it has a current processing capacity of one ton of fresh fruit per day.

Evidence suggests that women do have a role to play in improved traditional processing activities, but there remains much room for greater participation. The exposure of small-holder women at the Daru and Gambia-Mattru projects in Sierra Leone to improved processing techniques could be one method for increasing female participation. Opportunities for increased involvement might also exist in villages in the Ivory Coast's palm-oil producing areas.

Because improved processing equipment and small-scale plants are only just beginning to emerge, it is both difficult and premature to evaluate the role women will have in a small scale processing industry. Activities required to operate such facilities might not be of a nature to warrant significant inputs of female labour. In this connexion, the place of women in the industry will be a function of the degree of mechanization in small mills and of opportunities offered by specific, well-identified tasks. These two factors may vary from plant to plant: two examples of existing small-scale facilities currently in operation illustrate this.

In a small-scale mill near Benin City in Nigeria, with a daily capacity of one and-a-half tons, women work in three areas. They strip the fruit from the bunches; they then throw the fruit against a sifter (a cleaning or filtering net), which removes dirt; finally, they separate nuts from dried pulp following extraction, in order to

extract oil from the kernel. In Sierra Leone, the Mobai mill does not use a cleaning filter; women handle the clarification process and in particular, the removal of sludge, as well as a few ancillary activities. They are not, however, interested in sorting nuts for oil extraction, because of the small size of the kernels. In highly mechanized mills with automated nut-cracking devices this form of female labour would be unnecessary. However, where women are involved in extracting oil from kernels, the feasibility of a small-scale kernel-oil industry might be examined.

The plans for a small-scale mill in Northwest Cameroon and the role of women in the proposed plant suggest that rather than expecting an increase in women's participation in industrial processing activities, it may be more realistic to emphasize the role of women in ancillary processes and secondary activities connected to such facilities. Women's work in producing packaging material at Mobai, for instance, or the plans for soap production in Northwest Cameroon are cases in point. In this same region another idea might be to strengthen the organizational, financial and transportation structures of women's marketing co-operatives, to allow them to gain a greater share of the palm-oil retail trade. 16/ Indeed, individuals account for about 90 per cent of this trade, with the co-operatives controlling some 10 per cent at present. 17/

The strongest argument in favour of focussing on and defining the extent of female participation remains that the activities currently handled by women in small-scale processing plants represent low productivity areas which do not deserve further emphasis.

NOTES

Part Four

1/ FAO/UNECA, The Oil Palm Industry in Africa in light of the new International Economic Order, Addis Ababa, March 1977.

2/ Based on an interview held with the Director of Agricultural Production of Palmindustries on 29 September 1981.

3/ Republic of the Ivory Coast, Five-Year Plan for Economic, Social and Cultural Development, 1976-1980, Vol.II, p. 214.

4/ Results of discussions held with the Director of Société Ivoirienne de Technologies Tropicales and the Director of Agricultural Production of Palmindustries.

5/ Results of discussions held and observations made in two villages in the southern part of the Ivory Coast.

6/ Based on discussions held in September 1981 with Mr. Feika, Assistant Chief Agriculturalist at the Ministry of Agriculture and Forestry in Sierra Leone.

7/ Based on discussions held with Mr. Alpha, General Manager of the Daru Palm Oil Company, at NIFOR, Benin City, Nigeria, from 12 to 16 October 1981.

8/ This project is under the direction of Dr. B.M. Koba.

9/ Based on discussions held at the Cameroon Development Corporation at Victoria and at SOCOPALM at Dibombari in September 1981.

10/ W.S. Hartely, The Oil Palm, op.cit.

11/ This is quoted by Judy C. Bryson in Women and Economic Development in Cameroon, USAID/Yaounde, 1979, pp. 51-52. The original findings are attributed to Jacques Champound, Mom, Terroir Bassa, op.cit.

12/ Judy Bryson, op.cit.

13/ Benjamin Badjeck, Possibilités de Développement des Agro-Industries dans les Pays de l'Afrique Centrale I, MULPOC-Yaoundé, Commission Economique pour l'Afrique, Nations Unies, 579/8, p. 80.

14/ Thomas Fofoung Tata, Cameroon Country Report on the Production, Processing and Commercialisation of Palm Oil in Cameroon with special reference to the Northwest Province, presented at the First African Small-Scale Palm Oil Processing Workshop, October 12-16, 1981, NIFOR, Benin City, Nigeria.

15/ G. Blaak, Feasibility Study for a village palm oil mill, op.cit. p.22. Valuable insights into the situation in Northwest Cameroon have been provided through this study, and the ATRCW wishes to acknowledge this accordingly.

16/ Thomas Fofoung Tata, Cameroon Country Report, op.cit.

17/ Based on discussions held with Ben F. Wara, Deputy Director, Department of Co-operation and Mutuality, Yaounde, United Republic of Cameroon, in September 1981. Mr. Wara had recently been transferred from the Northwest Co-operation offices at the time of our discussions.

Part Five

CONCLUSION

GUIDELINES FOR INTRODUCING NEW TECHNOLOGIES AND RECOMMENDATIONS ON TECHNICAL DEVELOPMENTS AND THEIR DISSEMINATION

The following section concludes the study by submitting proposals and recommendations formulated on the basis of experiences in the Ivory Coast, Sierra Leone and the United Republic of Cameroon in the application of appropriate technologies in the palm-oil processing field. In a first part proposals are suggested for direct use in projects designed to introduce new processing technologies at the individual, village and small-scale industry levels. Essentially the proposals constitute a checklist for planners and group major issues which, if properly addressed, can enhance chances for user acceptance of new technologies.

The comments and recommendations contained in the second part focus primarily on technical issues: in particular they highlight a major need for palm-oil processors - access to information on the state-of-the-art in the development of appropriate technologies for use in palm-oil processing in Africa.

I. PROPOSED GUIDELINES IN INTRODUCING IMPROVED TECHNOLOGIES

The proposals identified in this part basically result from lessons gained from the Sierra Leone oil press project. Experience with application of the CENEEMA press in the United Republic of Cameroon also offers valid insights into the introduction of improved technologies for use by women in processing palm oil at the community and small-scale levels.

Except in the first case, proposals are not ranked in order of priority. They are, however, roughly categorized by topic.

A. Feasibility study

The most critical requirements for insuring successful introduction of a technology that satisfies local needs are completion of a pre-implementation feasibility study and incorporation of its findings in the designs of the technology itself and of the project as a whole. The study should include, inter alia, a sociological analysis, and thorough examinations of technical and economic factors that could influence design specifications and utilization of equipment.

The sociological analysis should cover factors such as the context in which traditional processing takes place, so as to enable the project to highlight changes in patterns of work upon introduction of the technology.

Technological areas of study should discuss the type of fruit to be processed, whether wild grove or improved varieties, as well as the implications this might have on specific design features of the proposed equipment; the range of by-products that can be obtained through use of the technology; mechanical features such as bridge or bucket-type press that would be more easily operated by women; and the comparative efficiency of different presses.

Items for economic consideration include a survey of the quantity of fruit available for processing on regional and seasonal bases; the yields of the fruit in the project area; the efficiency of the proposed system in terms of user need; labour requirements for the different processes under consideration and an examination of how these compare with traditional methods; the economic advantages or disadvantages of the new system compared with the traditional, and a listing of ancillary costs, such as fuelwood expenses in Sierra Leone, that could inhibit wide utilization of the technology.

The rationale for a feasibility study is that in order to prove practical and acceptable to users, a new technology must compare favourably on technical and economic grounds with existing traditional palm-oil processing methods.

Another requirement in the study, therefore, is a sound appreciation of traditional processing methods and their economic implications, with particular emphasis on labour inputs broken down by sex. An understanding of these factors will help to identify where mechanization is appropriate. Furthermore, by providing a description of female input into the process, a detailed analysis of the traditional method as proposed here 1/ will assist planners in a subsequent assessment of the impact of technological change on women's activities.

With this type of analysis in hand, project designers will be able to compare the proposed improved and existing traditional methods. Examples of criteria on which to base a comparison are listed below. 2/

- Degree of complexity of equipment and maintenance requirements;
- Costs;
- Profitability;
- Time consumption and labour requirements;
- Extraction efficiency;
- Yield;
- Throughput (quantity of fruit that can be processed);
- Appeal to users;
- Effect of technology on by-products and implications of change;
- Opportunities for secondary processing enterprises;
- Sociological implications.

B. Survey of existing technologies

A second proposal calls for a survey, the results of which should be incorporated in the feasibility study of improved processing technologies currently in use in the project area. The purpose is to ascertain the validity of the technical choice in terms of three factors: superiority of proposed equipment; usefulness to target beneficiaries; and absence of duplication on technical and user grounds. Furthermore, results from such a survey could yield technical data with which to improve the design of the equipment. From the standpoint of female users, a technical survey will later help to assess the rate of and reasons for utilization of existing technologies: this type of information could shed light on the probabilities for successful introduction of the new technology to women processors.

C. Methods for dissemination, introduction and follow-up

1. Dissemination

A third concern is the methodology employed to promote the new technology among target users. As discussed in the assessment of the Sierra Leone oil press project, this issue depends to a great extent on choosing the organization most apt to succeed in the task. Selection therefore requires formulation of specific criteria, chief among which is the experience of possible organizations in this type of work.

2. Introduction and follow-up activities

This heading covers all aspects required in the early stages of project implementation to introduce the technology. First the project must make provisions for adequate supervision and proper training of users, so that they fully appreciate the utility of the equipment and are proficient in its operation. Proper timing is another crucial issue. Experience in Sierra Leone has shown that oversight in this area can adversely affect the entire future of a project. Proper timing is further linked to another critical component, field testing of equipment. Absence of substantive field testing data will prevent identification of problems in the design features of the equipment.

The final issue covered under this proposal is the inclusion of a built-in project monitoring system, which will flag any shortcomings in a timely fashion, thus enabling project managers to modify and adjust specific aspects of the project when and as needed. 3/

D. Considerations for users

The final proposals suggested in this section are user-oriented. While they have been briefly discussed earlier, they are all of sufficient importance to warrant special mention here.

1. Identification of user need

This issue deserves particular attention, as it represents a major influencing factor in acceptance of the technology. There must essentially be insurance that target beneficiaries actually need and give a high priority to the proposed technology before any steps are taken to introduce it.

2. Cost-effectiveness of equipment

This proposal suggests that, prior to implementation, the project assess the cost-effectiveness of the equipment from the standpoint of capital investment costs for users. In other words the project planners should determine whether the technology is to be purchased by villages on a co-operative basis, whether fees are to be charged for its use and whether users can bear these costs.

3. Ownership and management of equipment

Ownership and subsequent management of equipment deserve thorough examination at the project design stage. These issues are instrumental in determining user access to the machine and its location in the village. Although a village committee was to be formed to set standards on these issues in the case of the Sierra Leone oil press project, the matter was never defined clearly, and lack of follow-up led to further problems in project implementation.

4. Maintenance of equipment

Adequate financial and technical provisions should be made for equipment maintenance. The experience in Sierra Leone indicates that wherever possible, maintenance by villagers themselves is preferable to reliance on outside contractors. An option would be to train local artisans such as blacksmiths in basic maintenance techniques.

5. User income

The final proposal focuses primarily on female users of new technologies. Projects should determine the extent to which women share in the proceeds derived from palm-oil processing. Obviously, if a project is submitted in an area where women do not earn the proceeds of their labours, the objective of increasing the productivity and earning capacity of women through introduction of appropriate technologies would require revision.

E. Conclusion

Annex II of this study contains a questionnaire originally intended for use in assessing results of the Sierra Leone oil press project. Although a number of items in the annex appear under the heading "Evaluation", the content can serve as a model in selecting and formulating questions to address the issues suggested in this section.

II. TECHNICAL DEVELOPMENTS AND THEIR DISSEMINATION

The study has proven that a wide range of technologies exists for improved traditional and small-scale palm oil processing industries. The following illustrates the correlation between equipment selection and land use and recommends that additional work go into developing palm-oil presses and devising methods for disseminating information on their existence.

A. Land use and selection of appropriate technologies

In designing projects to introduce appropriate palm-oil processing technologies to women at the village level it is essential to understand traditional patterns of land use in specific areas in order to select the technology most apt to satisfy local needs.

In the countries of the study the average smallholder cultivates between five and twelve acres; projects that introduce technologies to this beneficiary category would require use of a different type of equipment than those trying to develop small-scale processing industries to service co-operatives or plantations of 20 to 30 acres.

The study has examined equipment now in use in the Ivory Coast, Sierra Leone and the United Republic of Cameroon. It can roughly be divided into two categories, which correspond to the acreages discussed above. To process the produce generated on 5 to 12 acres, the most appropriate choice among technologies reviewed here is to combine a mechanized digester with an efficient press. The first component could be a CENEEMA depulper or a Colin Otele press; another option represents a development by the Nigerian Institute for Oil Palm Research (NIFOR) - a manual-mechanical digester with beaters. The second acreage listed above would require a larger processor to meet its needs: again, NIFOR has devised a horizontal digester and press system with a capacity to process one ton of fruit (f.f.b.) per hour. The Blaak village mills, which are soon to be established in northwestern Cameroon and already in place in Sierra Leone, are another option: they too have a one-ton capacity.

These two examples show the correlation between equipment and f.f.b. production. To make appropriate choices, however, there is a need for access to information on available technologies and, in some cases, for design of new systems as well.

B. New developments and their dissemination

1. Technological needs

A quick overview of equipment now available in the Ivory Coast, Sierra Leone and the United Republic of Cameroon and mention of NIFOR's recent models point to the existence of a wide range of small-scale technologies from which to select the equipment most apt to meet specific requirements. However, further research and design

are required in the development of palm oil presses for use by individuals in improved traditional processing. In particular, the palm-oil press industry needs to create and promote equipment specifically designed to address the requirements of women processors, since they represent the major portion of labour in traditional processing. Thus while the study certainly recommends further development and promotion of the NIFOR systems, major efforts should be directed at technologies for use by women producers. Perhaps NIFOR and CENEEMA, both of whom have developed successful appropriate technologies, might collaborate in this area. Another more cost-effective option would be to combine components of existing technologies. 4/

2. Diffusion of information on new technologies

The design and manufacture of presses for the Sierra Leone project prove that technical innovations, no matter how well intentioned they may be, can be costly if, upon completion, they do not satisfy the needs of end users. To avoid costly duplication of effort and to ensure maximum benefit from existing knowledge and innovations for the development of the food industry in Africa, the study recommends the establishment of an information centre or data bank 5/ on appropriate technologies, equipment and plants for food processing at the artisanal, small and intermediate levels. This would entail a survey of technologies for palm-oil processing in Africa and the collection of additional documentation on the experiences of Asia's major producing countries in this field. The MULPOCs would be ideally suited to oversee the collection of baseline data.

Results of the survey would need wide diffusion in order to be effective and useful. To accomplish this, it is recommended that findings be published in the form of an industrial catalogue, to be sold to African governments and private or public sector organizations, and to be updated every five years. Information to be contained in an industrial catalogue would include descriptive listings of existing technologies and of technologies in the process of development at relevant institutions throughout Africa: in this instance, the government of Cameroon's National Centre for Studies and Experimentation in Agricultural Mechanization (CENEEMA) and the Nigerian Institute for Oil Palm Research (NIFOR) would deserve mention. In addition the catalogue would need to list the major advantages and disadvantages of existing equipment. For this it would require basic information on the experience in application of each technology. A catalogue such as the one proposed, besides encouraging local inventions, would make a positive contribution to the promotion and further development of Africa's food industry.

NOTES

Part Five

1/ This was essentially the approach adopted by Traut, "Manpower and economic analysis of traditional palm oil processing in Cameroon" op.cit. This type of approach, if applied in traditional processing can be profitably improved given specific goals and objectives.

2/ Results of application of these criteria in similar comparisons for grain milling can be found in Pat Eastman, "An end to pounding - a new mechnical flour milling system in Africa", IDRC-1520, Ottawa.

3/ For more information on the relevance of this point, see Dharam Ghai, Martin Godfrey and Franklyn Lisk, "Planning for basic needs in Kenya", Performance Policies and Prospects, ILO, 1979, pp. 145.

4/ A similar point was stressed in papers by Dr. Vlavanou of the joint FAO/ECA Advisory Group on Food and Agricultural Industries Development in Africa (ACFI) (Addis Ababa) and in the Cameroon country report presented at the NIFOR workshop in Benin City, Nigeria.

5/ These recommendations were adopted at the First African Small-Scale Palm Oil Processing Workshop held at NIFOR in Benin City. They are included in the Report on the workshop published by the Food and Agriculture Organization of the United Nations in 1982.

ANNEX I
Page 1

SUMMARY DESCRIPTION OF PALM OIL PROCESSING TECHNOLOGIES

Background

This chapter consists of 2 appendices: the first describes the Nigerian Institute for Oil Palm Research (NIFOR) horizontal digester and hydraulic press system. The second is a comprehensive table of selected technologies for improved traditional palm oil processing. The table summarizes the major technical and economic characteristics of these technologies and inasmuch as possible, highlights the advantages and disadvantages of each; generally speaking, the descriptions are geared to the lay-man and do not purport to be highly technical, though some of them do provide relatively more information on technical characteristics than others.

The expression "improved traditional palm-oil processing" is understood to mean the application of a technology to one or more critical steps in the traditional processing of palm oil in an effort to ameliorate the processing method. Though technology may be applied to one activity, subsequent steps in the processing continue as before, using typical traditional ancillary equipment. For example, though crude oil may be obtained through pressing (application of technology to extraction of the oil), it must still be boiled with water in 44-gallon drums in a traditional manner, in order to obtain the pure oil.

Comment on table

The information summarized in the table of selected technologies for improved traditional processing has not, in all cases, been empirically verified, nor does it necessarily reflect the results of performance testing. It is primarily a first attempt at documenting what has been discovered in the course of the study.

In the case of the Tinkonko screw press in Sierra Leone and the presses in the village in the Ivory Coast for example, the data is "as reported" by the users, though it may be supplemented, where possible, with additional information such as efficiency rate derived from wider applications of such technologies elsewhere. In the case of the CENEEMA system in Cameroon, the information is "as reported" by the developers of the system and does not result from performance testing in the field. To a lesser extent this applies in the case of the NIFOR Horizontal Digester whose performance has been tested, and its hydraulic press whose expelling efficiency has still to be evaluated. In the case of the Ministry of Social Welfare Press in Sierra Leone, there has clearly been very little in the way of performance testing.

In contrast to this, the information on the Colin Press in Cameroon is the result of a measured yield study of the machine. It should be added here that the results are yields from machinery over 25 years old. Newer models could be expected to have higher yields and greater efficiency.

Finally, the comments included in the columns on economic dimensions and technical characteristics and on advantages and disadvantages are somewhat related. This particular information is far from exhaustive, and may well require additions. The reader is encouraged to improve it so as to make the table more meaningful and more useful.

The objective in presenting the table is merely to provide some appreciation of basic facts on and capabilities of various technologies. In so doing, the hope is to sensitize the reader to the issues or questions that may need recognition if there is to be wider application of technologies for improved traditional palm-oil processing - technologies that aim at serving the needs of the small-scale oil palm planter and processor at the village or community level.

APPENDIX I

Description of NIFOR's Horizontal Digester and Hydraulic Press System*

The Horizontal Digester and hydraulic press are the core components of the recently developed small-scale milling system which is a result of a joint NIFOR/FAO/UNDP Engineering Research and Development Programme that focusses its attention on the research and development of basic technology for the processing of palm fruit on a small scale.

The entire system consists of a sterilizer/cooker with a usable volume of 1,000 litres, a rapid digester or macerator with a usable volume of either 36 or 42 litres, a clarifier with a usable volume of 800 litres, a hand operated/hydraulic press, a rotary stripper and a multi-purpose digester/cooker/sterilizer with a usable volume of 150 litres.

The Rapid Digester

The digester or macerator is power driven with a small lister engine. It is a horizontal digester which macerates or mashes the sterilized and cooked palm fruit. The usable volume is 36 litres 36 litres of macerated or digested palm fruit is equivalent to 42 litres of loose or stripped fruit = 64.6 kilos of fresh fruit bunch (FFB). It has a through-put of about 250 kg of sterilized fruits per hour and is suitable for a 50-100 hectare plantation.

The Hydraulic Press

The hand operated hydraulic press has a usable volume of 36 litres. Its main features are that it consists of seven easily assembled components can be used in conjunction with almost any type of hydraulic ram, jack or screw device and can be used to expel the de-oiled fiber and nuts from the press cage.

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*The expose in this annex is from the pamphlet NIFOR (FAO) UNDP Engineering Research and Development Programme, Details and Specification of Equipment, First African Small Scale Palm Oil Processing Workshop, Oct. 12-16, 1981, NIFOR, Benin City, Nigeria.

Table 1: Selected technologies for improved traditional palm oil processing

APPENDIX II

NAME OF TECHNOLOGY LOCATION IN OPERATION	ECONOMIC CHARACTERISTICS	TECHNICAL CHARACTERISTICS	ADVANTAGES	DISADVANTAGES	AVAILABILITY	OTHER	COMMENTS
Oil press in Sierra Leone	Relatively low cost; labour input: 2 persons; firewood requirement for boiler represents important supplementary cost; pressing time: 10 mn; yield: 1 gallon/load;	Combination of press and boiler solves problem of high viscosity of oil; boiler capacity: 2 gallons; press capacity: app. 827 cu or 30 lbs. macerated fruit; light weight and manually operated; uses screwthread which eases operation by women; portable: easily carried by 2 persons. Note: press capacity estimated based on inner cylinder diameter of 9" and height of 13".	Ideal for small amounts of fruit; no separation of nuts needed with improved palm; free-flow of oil through use of boiler; easily portable; by-products after pressing same as with traditional method.	Inappropriate for large amounts of fruit; requires separation of fruit from nuts when using wild grove fruit; uses scarse firewood; boiler capacity is limited; blockages in flow of oil with improved fattier fruit; requires pounding of fruit before extraction.	Not available for commercial use.		Press has not been subjected to sufficient field tests therefore data on it is indicative at best.
Screw press (Tinkonko) in Sierra Leone and Ivory Coast (village of Kpass, Dabou)	Adequate for a 10-12 acre farm; labour input: 1 - 2 persons; yield: app. 1.5 gallons per load;	About 40" in diameter and 15" high; press capacity about 1/5th of 44 gallon drum of fruit (as reported by users); extraction efficiency 60-70 %.	Does not require separation of nut from pulp before pressing when using improved fruit; ideal for small holders with 9-12 acres of improved fruit; is operated by women.	Highest yields not obtainable with wild grove fruit without removing nuts prior to pressing.	Available for commercial use since 1940s.	Screw press comes in different sizes with varying press cage capacities; in the Ivory Coast a press 11" in diameter and 19½" high yielded 20 l. of oil per load of macerated fruit.	Considerable experience with use of this type of press in Asia and selected countries in Africa since 1950s
CENEEMA press and depulper Cameroon	Relatively inexpensive: 75,000 CFA for press and 25,000 CFA for depulper; labour input: 1-2 persons; discontinuous system; yield: one l per 10 kg of palm nuts.	Depulper operates manually on friction to macerate fruit; has 10 kg capacity; timing is 1 mn to load and 1 mn to depulp. Press has 40 kg capacity (fiber from 40 kg of nuts) and 8-10 ton pressure.	Depulper removes pulp from fruit, thus eliminates need for manual or foot crushing; press system is a simple jack; relatively inexpensive.	Requires manual separation of nuts from pulp before pressing.	Available for commercial use from CENEEMA in Yaounde, Cameroon; delivery time app. 3 weeks from date of order.	Press is essentially an improvement on existing models and resembles cage and curb presses.	Press was rejected by users upon introduction because of the need for separation of nuts; depulper is new and has not been promoted; little data is available on user experience since only 2-3 have been sold in Zaire and Cameroon.

Colin press Cameroun (Otele, Makak region of the Central-South Province)	Can be manually operated or power driven; labour input: 6-7 persons (manual) or 4-5 persons (power driven); yield: 30 l of oil per drum of wild grove palm and 45-50 l per drum of improved palm with manual operation; time: 30 mn to process one drum with motor, and one hour using manual system.	Continuous system: press macerates fruit and extracts oil at same time.	Depulping and extraction of oil at same time; only need is to feed fruit into system; manually operated or power driven; male and female operated; very high yields.		No longer in production but consideration is being given to renewed manufacture if enough orders are placed.	Expensive but owners use presses for commercial purposes, thus earn adequate returns on investment. Possible cost 1.2 to 1.6 million CFA.	Excellent solution of single system for improved traditional processing at small-scale level; should be able to have widespread applications.
Curb press Ivory Coast (Kpass village, Dabou)	Labour input: 4-5 persons; yield about 30 l per cage load (as reported).	Efficiency of press is generally 55-60 per cent. Cage is 22" in diameter and 20" high; average load of Duchscher NG1 is 70 kg of fruit or 115 kg of ffb.	No separation of fruit from nuts before pressing improved palm; the press is ideal in Kpass, where there are small amounts of improved fruit.	Women find operation of the press tiring; pounding in a mortar is still needed.	Not currently available in the Ivory Coast; press in village dates back to the 1950s.	Villagers anxious to obtain another press with improved pressing mechanism to facilitate use by women.	Press is being used commercially by villagers, they are prepared to pay 40,000 CFA or more to obtain a new press.
Mechanical digester **Nigeria(NIFOR), Benin City**	Cost of production is low; timing: 15-20mn to macerate abour 5 kg of boiled fruit.	Manually operated; digestion or maceration of boiled fruit is done by means of beaters that were found to operate well and efficiently	Hygienic; considerable maceration capability; efficient; eliminates manual pounding or foot crushing.	While efficiency rate is good, the press designed to complement it was found to be deficient and has not been promoted, nor has consideration been given to further development for wide-scale application.	No longer being produced by NIFOR thus unavailable.		It could be a solution to labour requirements which are increasingly expensive. Deserves re-assessment for wide-scale application.
Horizontal fruit digester and hydraulic press system. Nigeria, NIFOR	**Designed and fabricated in Nigeria at an estimated cost of 12,000 Naira.** Suitable for 50-100 ha plantations; labour input: 7 men to operate the entire system including ancillary equipment.	Digester has a throughput of 250 kg of sterilized fruit per hour; usable volume of either 36 or 42 l; press uses a hydraulic system and has a press cage capacity of of 36 l; partly hand-operated in order to increase speed; can be used to expel pressed fiber and nuts from the press cage.	Provides for both maceration and pressing in a discontinuous system; no separation of nuts from pulp needed; appropriate for co-operative or small-scale processing; press comprises 7 easily assembled components; very adaptable, can be used with almost any type of hydraulic, ram, jack or screw device.	Not suitable for average smallholder producers; energy requirements are considerable.	Digester is ready for commercial production now that alterations have been completed; press has not been tested, will require more work.	System operates with ancillary equipment required in small-scale milling, such as a sterilizer, a bunch stripper, a cooker and clarifier.	Performance of system not tested. Could prove expensive to operate at small-scale individual level; it was designed to service co-operative units.

ANNEX II

QUESTIONNAIRE FOR CRITICAL ASSESSMENT OF OIL PRESS PROJECT IN SIERRA LEONE

The questionnaire which follows was originally intended for use in assessing results of the Sierra Leone oil press project: a number of questions, therefore, reflect geographical limitations and would need to be re-phrased if applied in another African country.

In addition the questionnaire aimed at gathering information for a thorough evaluation of a project: a number of questions address post-implementation issues. In spite of this, a number of points are raised that would also be relevant in a survey conducted prior to designing a project to introduce palm oil processing equipment at the village or small-scale level.

A. BACKGROUND QUESTIONS:

I. What is the extent of traditional and small-scale palm-oil processing in Sierra Leone? In other words, is palm oil processing in Sierra Leone largely traditional and small-scale or not?

II. What does the traditional processing consist of? What does it involve? What are the different stages?

III. Are there different traditional ways for processing the oil?

(1) Which tends to be used most frequently and why?

(2) Does the method tend to vary in different parts of the country?

IV. What exactly is the place of women in traditional processing? What role do they play in the different stages?

V. In processing one 44-gallon drum of palm fruit,

(a) How much oil is yielded?

(b) How much time is required?

(c) What is the labour input required by male and female labour for each specific activity or stage listed below?

Activity	Labour Inputs (No. of hrs) Man/Hours	Female/Hours
. Harvesting (No.persons involved)		
. Stripping of bunches (No.persons)		
. Fermentation "		
. Collection of firewood "		
. Cooking of fruit		
. Transfer of boiled fruit		
. " into dug-out-pit		
. Crushing fruit by foot		
. Collection of water		
. Collection of crude oil (No. persons involved)		
. Squeezing of pulp "		
. Boiling of crude oil Skimming off pure oil		

Activity	Labour Inputs (No. of hrs) Man/Hours	Female/Hours
. Collection of by-product (No. of persons involved)		
. (Sludge for soap making)		
. Collection of nuts from dug-out pit after taking out crude oil		
. Marketing of palm oil		

VI. What proportion of the income from the processed oil do women earn?

What arrangements exist between the men and women for sharing the proceeds of the production?

VII. What are the major problems and difficulties of women producers in this field?

B. QUESTIONS FOR EVALUATION OF PRESS PROJECT

I. General

(1) How many hand presses are there in all in the project?

(2) a) In how many districts and villages have the presses been introduced?

b) How many presses are there in each of these villages?

c) In how many of the villages where they have been introduced are the presses operating?

Effects of Press on Traditional Method of Processing

II. Technological

(1) Does use of press reduce labour input as compared with the traditional method? How?

(2) Are the presses able to cope with the demands of processing in terms of quantity of fruit available to processors?

(a) Are they efficient in terms of quantity of oil extracted and capacity?

(b) Do the presses produce a greater quantity and better quality of oil than traditional means in villages where introduced? (Drums of oil produced relative to traditional)

(c) What is the extraction rate of oil?

(d) Is the process faster?

III. Economics

(1) What is the cost of the machine?

(2) Has the cost proved manageable on an individual or community basis?

(3) What has been the return on investment? What is monthly profit?

(4) How many years would it take an individual or operator to cover the cost of the press?

(5) Who controls use of the press? Is it village controlled or do individual men or women manage it?

(6) Who earns the income after pressing?

(7) Has the availability of the press increased women's income generation? Please give examples.

(a) If not, why not?

(b) What proportion of the income do women earn?

(c) How significant an income generating activity was oil palm extraction for women before introduction of the press and now?

IV. Press Utilization

(1) Are the presses widely used as opposed to traditional approaches?

(a) If not, why not?

(2) What have been some of the problems experienced with utilization of the presses?

(3) When the presses were introduced, should anything have been done differently to assure greater acceptance?

(4) Are there any aspects of the operation of the press that are difficult for or put a strain on women?

(5) Are there any particular guidelines that should have been kept in mind in the introduction of the presses for:

(a) use by women?

(b) use at small-scale level?

(6) Do the presses require any improvements to facilitate wider acceptance?

V Supply

(1) What is the source of supply of fruit for processing?

(a) Natural grove or improved varieties from estates?

(b) Are there any problems with adequacy of supply?

(c) Is there ever a greater supply of fruit than can be processed? Any oversupply problem?

(2) Can the presses process all the fruit available for processing?

(3) What is the volume of fruit processed at village level?

VI. By-products

(1) After processing, who markets palm kernels - men or women?

(a) Are they sold to SLPMB or processed locally?

(b) If the latter, what method is used? Who does it?

(c) If sold, who earns the income?

(2) What uses are made of the pulp after processing? What of the shells from nuts after extraction of kernel oil?

(a) Is there anyway that their usefulness has been affected by change in production method - e.g. press?

(b) Could their usefulness be further improved?

VII. Sociological

(1) Has introduction of press brought about any change in in the pattern of work and work habits? How?

(a) male

(b) female

(2) Has introduction of the presses brought about any changes in the roles of men, women and children in the production and processing of palm oil?

(3) Has palm oil processing become more, or less of a family activity now than before introduction of the press? In what way?

(4) Has there been any change in time of day required to do any task?

(5) How do the women view the press?

(a) Do they feel there has been any effort to relieve their workload? Why or why not?

(b) Do they feel their status has been enhanced by introduction of the press?

(c) Has introduction of the press helped to resolve any problems or difficulties they were experiencing?

(d) What do they like about the press?

(e) What do they dislike about it?

(f) Do they feel their role in palm-oil processing has been adversely affected by the press? In what way?

(g) Do they feel they are better off with the press or not? How? In what way?

VIII. Overall - General

(1) Is there a place for improved traditional palm-oil processing in Sierra Leone? In what way, specifically? In other words, which stages or aspects of traditional processing could be improved? Can women participate?

(2) Is there a place for small-scale palm-oil processing industries in Sierra Leone? In other words, is there a place for use of willage mills or other technoloiges?

(a) Can women be expected to participate in this? Is there a role for them at small-scale processing industry levels?

(b) In what way?

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